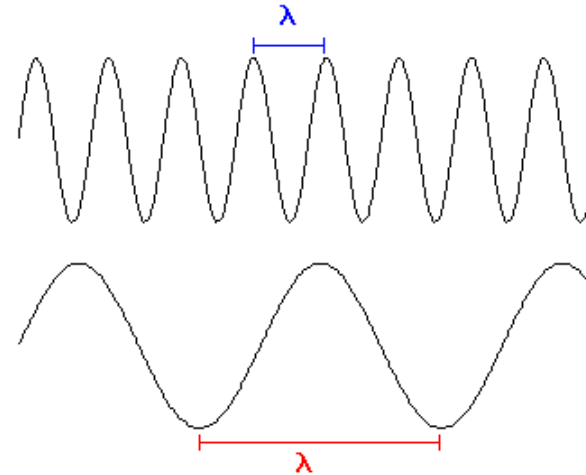


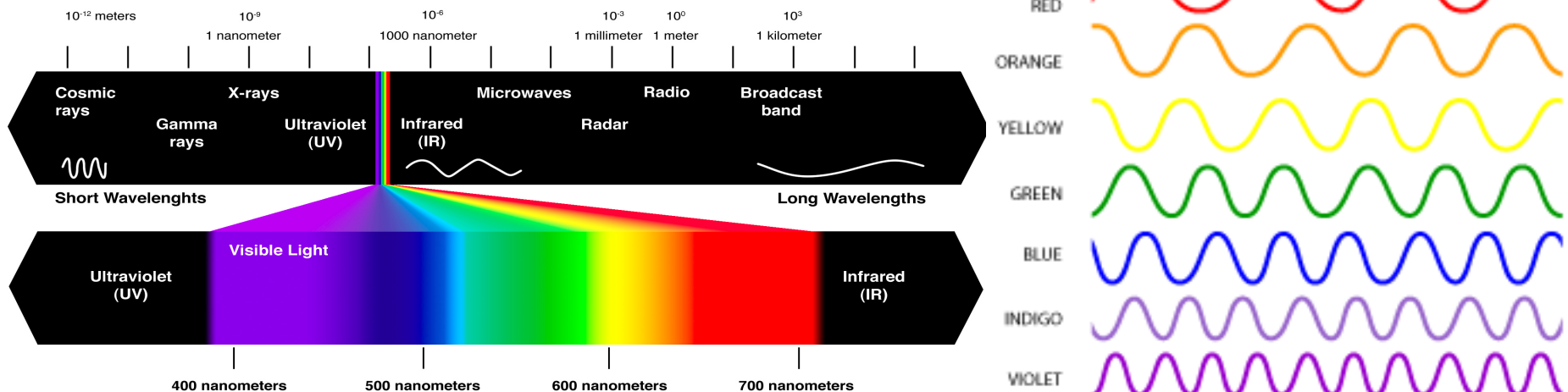
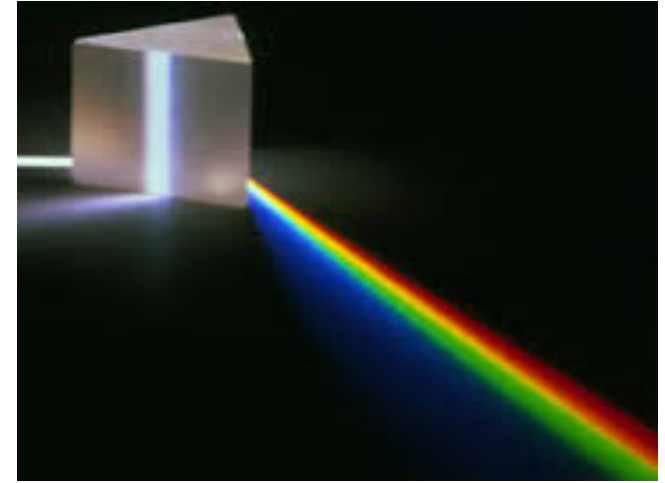
Study of Light



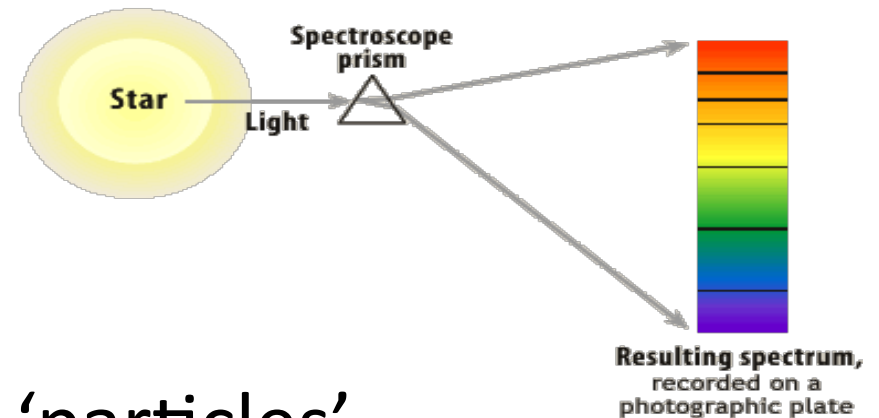
- **Isaac Newton** (1666): studied light traveling through a prism & saw a spectrum of colors: ROYGBIV (rainbow)
- **Christiaan Huygens** (1670s): determined light travels in waves; shorter wavelengths are refracted (bent) more than longer wavelengths

Nature of Light

- Light can be described in two ways:
 1. Particles: photons
 2. Waves
 - Wavelength: distance from one wave crest to the next
 - We are able to observe a small fraction of light known as visible light
 - Visible light passes through a prism → demonstrates that visible light consists of a range of waves with various wavelengths



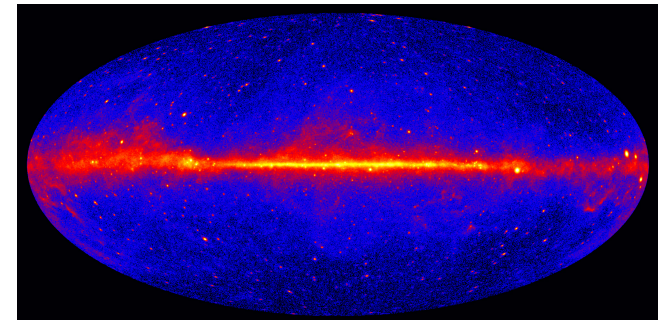
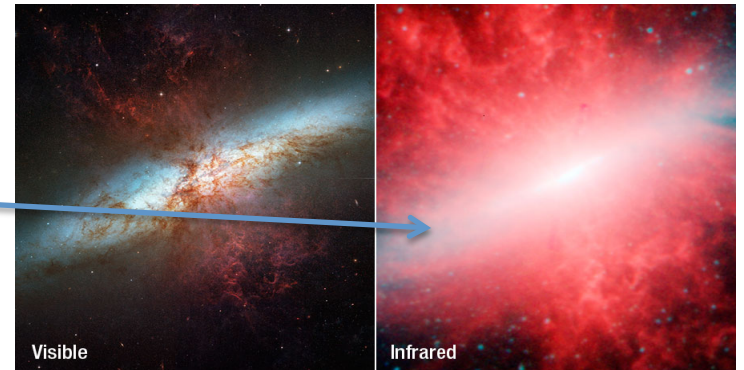
Sun's Light



- Photons: stream of light ‘particles’
 - Like very small bullets fired from a machine gun
 - Shorter wavelengths have more energetic photons than longer wavelengths → blue light has more energetic photons than red light)
- Visible spectrum is only a small part of the entire spectrum of electromagnetic radiation given off by stars/galaxies

Electromagnetic Radiation

- Electromagnetic waves
 - Range of electric and magnetic waves that travel through space
 - Transfer energy
 - Arranged according to their wavelength & frequency
- Include:
 - Ultraviolet (UV) light=sunburns
 - Infrared= heat
 - X-rays
 - Microwaves
 - Gamma rays= radioactive elements
 - Visible light
 - Radio waves



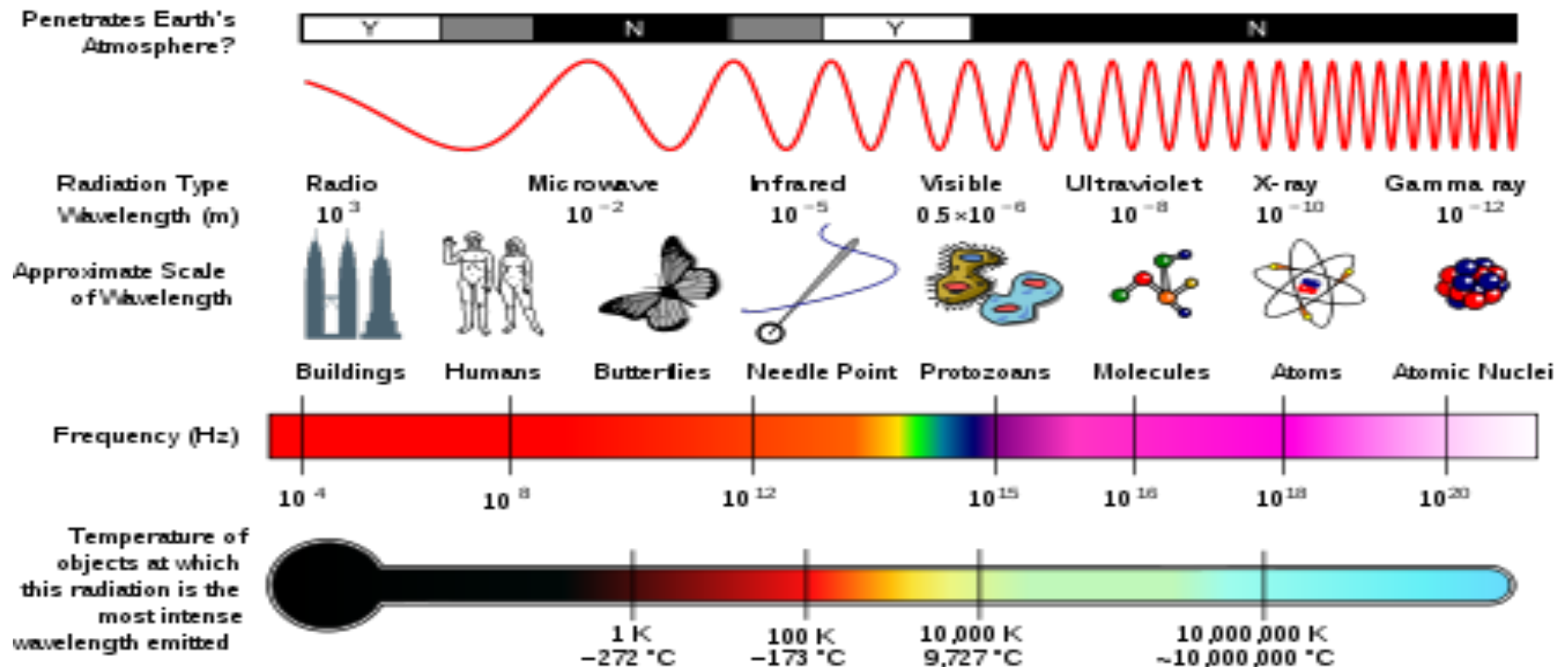
Pulsating neutron stars; gamma

Electromagnetic Spectrum: the continuum of radiation released by stars

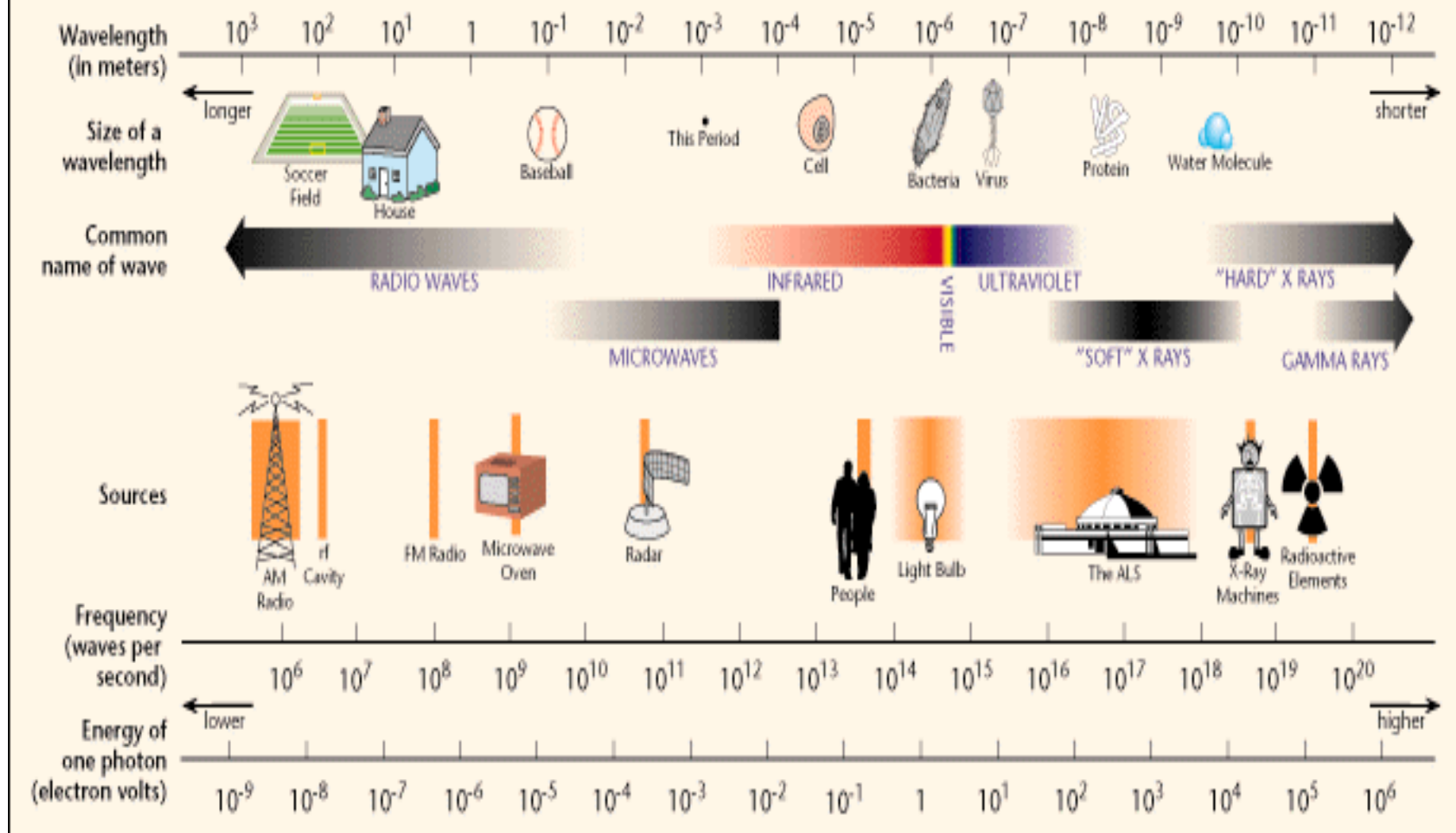
--Classified by wavelength (red longer, blue shorter)

--**Frequency**=the # of waves that pass a point per second

As wavelength decreases, freq. increases ← they are inversely proportional



THE ELECTROMAGNETIC SPECTRUM



How is this info. used by astronomers?

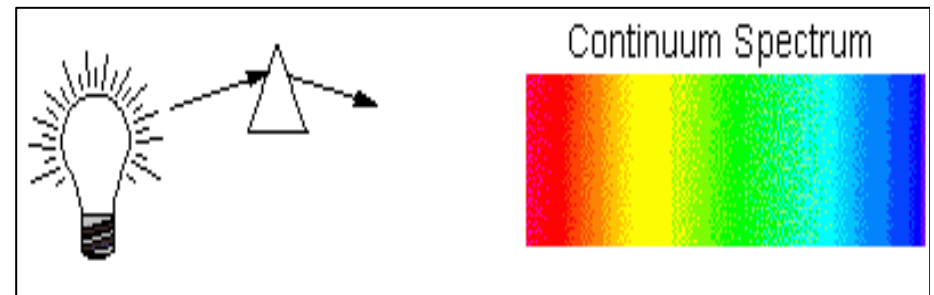
- Visible light= temperature of stars
- Interferometry: combines several telescope images to make a very detailed image
- X-ray telescopes=picks up energy (radiation) from supernova explosions, galaxies & black holes
- Hubble telescope=infrared instruments pick up nebulae & cool stars

Spectroscopy

- Study of the properties of light depending on wavelength
- Can study spectral lines (like 'fingerprints') to identify elements in stars
- Different types of spectra produced under certain conditions

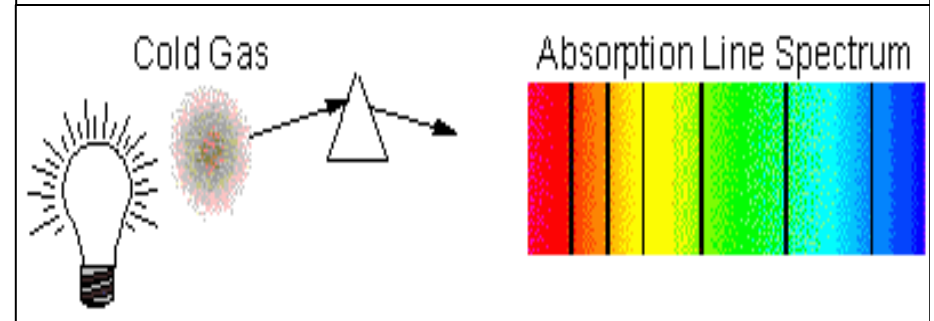
- Continuous Spectrum

- Produced by an incandescent solid, liquid, or gas under high pressure → spectrum is **continuous** with no gaps



- Absorption Spectrum

Produced when visible light is passed through a cool gas under low pressure → gas **absorbs** selected wavelengths of light → series of **dark lines**



- Emission Spectrum

Produced by a hot gas under low pressure → series of **bright lines** of particular wavelengths, depending on the gas → bright lines that mimic **absorption** lines

